

WHAT IS CLAIMED IS:

1. A method for moving a main chuck on which  
first objects are set in X, Y, Z, and  $\theta$  directions to  
align the first objects with second objects arranged  
5 above the first objects, the method comprising:

(a) photographing the second objects through  
second photographing means to obtain second  
photographed images;

10 (b) displaying second virtual data images in a  
second image data area on a monitor screen of a display  
device on the basis of the second photographed images  
of the second objects;

15 (c) allowing an optical axis of the second  
photographing means to match an optical axis of first  
movable photographing means to obtain a reference  
position of the main chuck;

20 (d) moving the main chuck to align the first  
objects with the first photographing means and then  
photographing the first objects through the first  
photographing means to obtain first photographed  
images;

25 (e) displaying first virtual data images of the  
first photographed images in a first image data area on  
the monitor screen of the display device on the basis  
of design data of the first objects;

(f) relatively moving the first virtual data  
images and the second virtual data images on the

monitor screen to superimpose both the virtual data images on each other; and

(g) determining a position where both the virtual data images are most fitly superimposed on each other as an alignment position of the first and second objects.

2. The method according to claim 1, wherein the second photographing means is provided for the main chuck.

3. The method according to claim 1, wherein the first objects are a plurality of electrode pads formed on an object to be inspected and the second objects are a plurality of contactors to be electrically brought into contact with the electrode pads.

4. The method according to claim 3, wherein in (b), the second virtual data images of the contactors are displayed with a color having a uniform density,

in (d), the electrode pads to be photographed by the first photographing means are reference electrodes for alignment among the plurality of electrode pads formed on the object to be inspected,

in (e), the first virtual data images of the electrode pads are displayed with dark and light colors, and

in (f), a position where an image density is most changed due to the superimposition of the first virtual

data image and the second virtual data image is set to a position where both the virtual data images are superimposed on each other so that both the images are most fitly superimposed on each other.

5           5. A method for aligning a plurality of electrode pads arranged on an object to be inspected with a plurality of contacts formed on a probe card, the method comprising:

10           (a) photographing predetermined electrode pads among the electrode pads through first photographing means to obtain first photographed images;

15           (b) displaying first virtual data images corresponding to the predetermined electrode pads in a first image data area on a monitor screen of a display device on the basis of the first photographed images and design data of the predetermined electrode pads,

20           the first virtual data images being colored and the color denoting either of a color having a uniform density and a color having a distributed density;

          (c) photographing the contactors through second photographing means to obtain second photographed images;

25           (d) displaying second virtual data images of the contactors corresponding to the second photographed images in a second image data area on the monitor screen of the display device,

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the second virtual data images being colored and the color denoting either of a color having a distributed density and a color having a uniform density;

5 (e) relatively moving the first virtual data images and the second virtual data images on the monitor screen to superimpose both the virtual data images on each other and then measuring the luminance of each portion where both the virtual data images are  
10 superimposed on each other;

(f) detecting a superimposing state of the first virtual data image and the second virtual data image on the basis of the luminance measured in the (e);

(g) detecting a distance relatively traveled by  
15 both the virtual data images until the superimposition of the first virtual data images and the second virtual data images is set to a predetermined state according to (f); and

(h) relatively moving the electrode pads and the  
20 contactors on the basis of the traveled distance to align the pads with the contactors.

6. The method according to claim 5, wherein in (e), the luminance to be measured is a change in luminance.

25 7. The method according to claim 5, wherein in (f), the superimposing state of the first virtual data images and second virtual data images is detected on

the basis of a comparison of the measured luminance with a predetermined luminance value.

8. The method according to claim 5, wherein in (f), the superimposing state of the first virtual data images and the second virtual data images is grasped on the basis of a detection result indicating that the measured luminance denotes one of a maximum value and a minimum value.

9. The method according to claim 5, wherein in (d), each second virtual data image formed in the second image data area is one of an image obtained by enlarging a photographed image of each contactor and an image obtained by reducing the photographed image.

10. The method according to claim 5, wherein the predetermined electrode pads in (a) are all of the electrode pads on the object to be inspected, and the contactors in (c) are the contactors corresponding to all of the electrode pads.

11. The method according to claim 5, wherein the predetermined electrode pads among the electrode pads in (a) are reference electrodes for alignment.

12. A method for detecting a superimposing state of first objects and second objects arranged so as to face the first objects, the method comprising:

(a) photographing the first objects through first photographing means to obtain first photographed images;

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(f) detecting a superimposing state of the first

virtual data images and the second virtual data images on the basis of the luminance value measured in the (e).

13. The method according to claim 12, wherein the first objects are a plurality of reference marks  
5 arranged in predetermined positions on a substrate and the second objects are a plurality of contact formed on a probe card.

14. An apparatus for moving a main chuck on which first objects are set in X, Y, Z, and  $\theta$   
10 directions to align the first objects with second objects arranged above the first objects, the apparatus comprising:

second photographing means for photographing the second objects to obtain second photographed images;

15 means for displaying second virtual data images in a second image data area on a monitor screen of a display device on the basis of the second photographed images of the second objects;

20 means for allowing an optical axis of the second photographing means to match an optical axis of first movable photographing means to obtain a reference position of the main chuck;

25 means for moving the main chuck to align the first objects with the first photographing means and then allowing the first photographing means to photograph the first objects to obtain first photographed images;

means for displaying first virtual data images of the first photographed images in a first image data area on the monitor screen of the display device on the basis of design data of the first objects;

5 means for relatively moving the first virtual data images and second virtual data images on the monitor screen to superimpose both the virtual data images on each other; and

10 means for determining a position where both the virtual data images are most fitly superimposed on each other as an alignment position of the first and second objects.

15 15. The apparatus according to claim 14, wherein the second photographing means is provided for the main chuck.

20 16. The apparatus according to claim 14, wherein the first objects are a plurality of electrode pads formed on an object to be inspected and the second objects are a plurality of contacts to be electrically brought into contact with the electrode pads.

17. The apparatus according to claim 16, wherein the second virtual data images are displayed with a color having a uniform density,

25 the electrode pads photographed by the first photographing means are reference electrodes for alignment among the electrode pads formed on the object to be inspected,



the first virtual data images of the electrode pads are displayed with dark and light colors, and

the superimposing means determines a position where an image density is most changed due to the superimposition of the first virtual data images and the second virtual data images as a position where both the virtual data images are superimposed on each other so that both the images are most fitly superimposed on each other.

18. An apparatus for aligning a plurality of electrode pads arranged on an object to be inspected with a plurality of contactors formed on a probe card, the apparatus comprising:

first photographing means for photographing predetermined electrode pads among the electrode pads to obtain first photographed images;

means for displaying first virtual data images corresponding to the predetermined electrode pads in a first image data area on a monitor screen of a display device on the basis of the first photographed images and design data of the predetermined electrode pads,

the first virtual data images being colored and the color denoting either of a color having a uniform density and a color having a distributed density;

second photographing means for photographing the contactors to obtain second photographed images;

means for displaying second virtual data images of the contactors corresponding to the second photographed images in a second image data area on the monitor screen of the display device,

5           the second virtual data images being colored and the color denoting either of a color having a distributed density and a color having a uniform density;

10           means for relatively moving the first virtual data images and the second virtual data images on the monitor screen to superimpose both the virtual data images on each other and then measuring the luminance of a portion where both the virtual data images are superimposed on each other;

15           means for detecting a superimposing state of the first virtual data images and the second virtual data images on the basis of the measured luminance;

20           means for detecting a distance relatively traveled by both the virtual data images until the superimposition of the first virtual data images and the second virtual data images is set to a predetermined state by the means for detecting the superimposing state; and

25           means for relatively moving the electrode pads and the contactors on the basis of the traveled distance to align the pads with the contactors.

19. The apparatus according to claim 18, wherein

the luminance measured by the means for measuring the luminance is a change in luminance.

20. The apparatus according to claim 18, wherein the means for detecting the superimposing state detects the superimposing state on the basis of a comparison of the measured luminance with a predetermined luminance value.

21. The apparatus according to claim 18, wherein the means for detecting the superimposing state grasps the superimposing state of the first virtual data images and the second virtual data images on the basis of a detection result indicating that the measured luminance denotes one of a maximum value and a minimum value.

22. The apparatus according to claim 18, wherein each second virtual data image formed in the second image data area through the displaying means is one of an image obtained by enlarging a photographed image of each contactor and an image obtained by reducing the photographed image.

23. The apparatus according to claim 18, wherein the predetermined electrode pads photographed by the first photographing means are all of the electrode pads on the object to be inspected, and

the contactors photographed by the second photographing means are the contactors corresponding to all of the electrode pads.

24. The apparatus according to claim 18, wherein the electrode pads photographed by the first photographing means are reference electrodes for alignment.

5        25. An apparatus for detecting a superimposing state of first objects and second objects arranged so as to face the first objects, the apparatus comprising:

first photographing means for photographing the first objects to obtain first photographed images;

10        means for forming first virtual data images corresponding to the first objects in a first image data area on a monitor screen of a display device on the basis of the first photographed images and design data of the first objects,

15        the first virtual data images being colored and the color denoting either of a color having a uniform density and a color having a distributed density;

20        second photographing means for photographing the second objects to obtain second photographed images;

25        means for forming second virtual data images corresponding to the second objects in a second image data area on the monitor screen of the display device on the basis of the photographed images of the second objects,

the second virtual data images being colored and the color denoting either of a

color having a distributed density and a color  
having a uniform density;

means for relatively moving the first virtual data  
images and the second virtual data images on the  
5 monitor screen to superimpose both the virtual data  
images on each other and then measuring the luminance  
of each superimposing portion; and

means for detecting a superimposing state of the  
first virtual data images and the second virtual data  
10 images on the basis of the measured luminance value.

26. The apparatus according to claim 25, wherein  
the first objects are a plurality of reference marks  
arranged in predetermined positions on a substrate and  
the second objects are a plurality of contacts formed  
15 on a probe card.

27. An apparatus for moving a main chuck on  
which a first object is set in X, Y, Z, and  $\theta$   
directions to align the first object with second  
objects arranged above the first object, the apparatus  
20 comprising:

first photographing means for photographing the  
first object;

second photographing means for photographing the  
second objects;

25 first image forming means for forming image data  
of the first object on the basis of data obtained by  
the first photographing means;

second image forming means for forming image data of the second objects on the basis of data obtained by the second photographing means;

5 dark and light portions applying means for applying dark and light portions to the image data formed by the first and second image forming means;

10 means for relatively moving the image data of the first object and the image data of the second objects, to which the dark and light portions are applied by the dark and light portions applying means, to superimpose both the images on each other;

15 luminance detecting means for detecting at least one of a position having the lowest luminance and a position having the highest luminance on the basis of the luminance of the images superimposed by the superimposing means; and

20 aligning means for aligning the first object with the second objects by moving both the objects on the basis of the detection result obtained by the luminance detecting means.

25 28. The apparatus according to claim 27, wherein the first object is a wafer, first images are a plurality of electrode pads formed on the wafer, and the second objects are a plurality of probes to be come into contact with the electrode pads.

29. A method for moving a main chuck on which a first object is set in X, Y, Z, and  $\theta$  directions to

align the first object with second objects arranged  
above the first object, the method comprising:

(a) photographing the first object;

(b) photographing the second objects;

5 (c) forming image data of the first object on the  
basis of photographing data of the photographed first  
object;

(d) forming image data of the second objects on  
the basis of photographing data of the photographed  
10 second objects;

(e) applying dark and light portions to images of  
the first and second image data;

(f) relatively moving the image data of the first  
object and the image data of the second objects, to  
15 which the dark and light portions are applied, to  
superimpose both images on each other;

(g) detecting at least one of a position having  
the lowest luminance and a position having the highest  
luminance on the basis of the luminance of the  
20 superimposed images; and

(h) moving the first object and the second objects  
on the basis of the detected luminance value to align  
both the objects with each other.

30. The method according to claim 29, wherein the  
25 first object is a wafer, the first images are a  
plurality of electrode pads formed on the wafer, and  
the second objects are a plurality of probes to be come

into contact with the electrode pads.

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